Notice of Allowability	Application No.	Applicant(s)
	10/734,795	MULDOWNEY, GREGORY P.
	Examiner	Art Unit
	George Nguyen	3723

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to _____.

2. ☒ The allowed claim(s) is/are *1-10*.

3. ☒ The drawings filed on *11 December 2003* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 040904
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

GEORGE NGUYEN
PRIMARY EXAMINER

REASONS FOR ALLOWANCE

1. The following is an examiner's statement of reasons for allowance: the specific limitations of "a boundary located at ... the first side" in the combination as claimed in claim 1, and "determining the location of a boundary ... of the polishing layer" in the combination as claimed in claim 7 are not anticipated nor made obvious by the prior art of record in the examiner' opinion. For example, with reference to Figure 3, Lin et al.'6,120,366 discloses a polishing pad comprising a plurality of annular grooves and a plurality of streamline grooves designed according to principles of the hydrodynamics. The streamline grooves of polishing pad of the polishing pad are designed according to flow equations derived from the source flow and vortex flow, and the streamline grooves of polishing pad uniformly distribute the slurry on the polishing pad. An angle and a depth of the streamline groove, which are calculated by boundary layer effect of the streamline groove function, are used to design an optimum structure.

FIG. 3 is schematic, top view showing the chemical-mechanical polishing pad according to the preferred embodiment of this invention. Referring to FIG. 3, a polishing pad having primary annular grooves 30 and streamline grooves 32 designed according to principles of hydrodynamics is provided.

Moreover, if a boundary layer effect is further considered, the streamline groove function described above can be used to compute a best angle of attack and depth of streamline groove, so that the optimum structure for a polishing pad is obtained. A set of equations:

$$u\frac{\partial u}{\partial r}-\frac{v^2}{r}+w\frac{\partial u}{\partial z}=-\frac{1}{\rho}\frac{\partial P}{\partial r}+\nu\left[\frac{\partial^2 u}{\partial r^2}+\frac{\partial}{\partial r}\left(\frac{u}{r}\right)+\frac{\partial^2 u}{\partial z^2}\right]; \quad (4)$$

$$u\frac{\partial v}{\partial r}+\frac{uv}{r}+w\frac{\partial v}{\partial z}=\nu\left[\frac{\partial^2 v}{\partial r^2}+\frac{\partial}{\partial r}\left(\frac{v}{r}\right)+\frac{\partial^2 v}{\partial z^2}\right]; \text{ and} \quad (5)$$

$$u\frac{\partial w}{\partial r}+w\frac{\partial w}{\partial z}=-\frac{1}{\rho}\frac{\partial P}{\partial z}+\nu\left[\frac{\partial^2 w}{\partial r^2}+\frac{1}{r}\left(\frac{\partial w}{\partial r}\right)+\frac{\partial^2 w}{\partial z^2}\right] \quad (6)$$

are considered where equations (4), (5) and (6) are Navier-Stokes equations. u, v and w are respectively velocity for the r, θ and z components, ρ is density of slurry, ν is dynamic viscosity and p is pressure. The boundary conditions are:

z=0, u=0, v=−ωr, w=0; and

z=∞, u=0, v=0,

where ω is angular velocity.

A formula shown in Eq. (7),

$$\tau_\omega \cdot \sin\theta \delta r d s = \rho \cdot r \omega^2 \cdot \delta d r d s. \quad (7)$$

is also used.

The following equations (8) and (9):

$$\xi = z/\delta = z\sqrt{\frac{\omega}{\nu}}, \quad (8)$$

$$u = \omega \cdot r \cdot F(\xi),\ v = \omega \cdot r \cdot G(\xi),\ w = \sqrt{\omega \cdot \nu} \cdot H(\xi),$$

$$P = \rho \nu \omega P(\xi), \quad (9)$$

where τω is viscosity, δ is fluid layer thickness are applied for variable transformation. According to the Eqs. (4), (5), (6), (7), (8), (9), the following equations can be obtained:

$$2F+H'=0,\ F^2+F'H-G^2-F''=0,\ 2FG+HG'-G''=0,\ P'+HH'-H''=0, \quad (10)$$

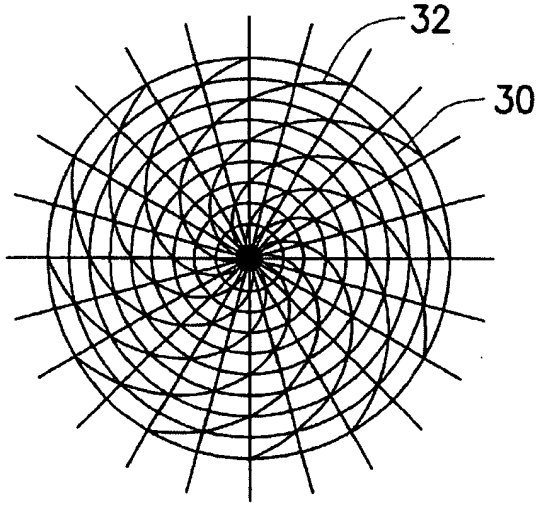
which boundary conduction are:

$$\xi=0,\ F=0,\ G=-1,\ H=0,\ P=0; \text{ and}$$

$$\xi=\infty,\ F=0,\ G=0.$$

The equation of original angle of attack of the streamline groove is also used:

$$\tan\delta_0 = -\left(\frac{\frac{\partial u}{\partial z}}{\frac{\partial v}{\partial z}}\right)_{z=0} = -\frac{F'(0)}{G'(0)} \quad (11)$$



However, the prior art of record fails to provide or disclose the specific limitations of "a boundary located at ... the first side" in the combination as claimed in claim 1, and "determining the location of a boundary ... of the polishing layer" in the combination as claimed in claim 7.

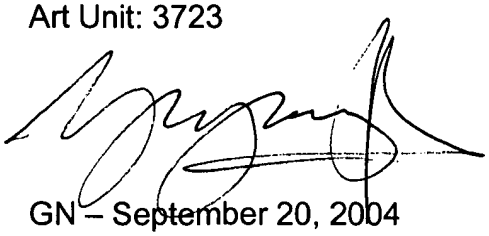
Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 703-308-0163. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 703-308-2687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

George Nguyen



Primary Examiner
Art Unit 3723

GN – September 20, 2004

GEORGE NGUYEN
PRIMARY EXAMINER